Connecticut Valley depression with its Triassic traps and sandstones stands over against the similar narrow Triassic basin of the Bay of Fundy, continued in the Boston and Narragansett basins. There remains the broad central New England Plateau, made up of great late-Carboniferous granite batholites running north and south, or with a little easting and isolated by bands, often very narrow, of late Paleozoic rocks, largely Carboniferous.

The series of batholites in this central plateau is itself symmetrically arranged and becomes more basic from the center outwardly.

Crossing the center of the plateau from north to south is the broad Hubbardston-Princeton band of granite which is truncated by erosion so nearly along its contact with the cover of Carboniferous schists, that it is everywhere contaminated with the sillimanite and graphite of these schists, and is made coarsely pegmatitic from the water obtained from them.

Next on the east is the long train of oval batholites running through Worcester, the Ayre series, which are of uniform porphyritic texture, and are matched on the west by the coarsely porphyritic Coy's Hill series, passing east of Ware.

Next outwardly the dark biotite Bolton granite-gneiss on the east is matched by the broad band of the black Hardwick biotite granite, passing through Ware.

Then follows on the east the fine-grained Milford biotite granite, so valuable as a building stone, which is comparable with the Monson and Pelham biotite granites on the west, which are also extensively quarried.

Finally, the complex Quincey-Dedham series of igneous rocks along the eastern border of the area, with its basic and soda-rich rocks, is balanced by the basic Belchertown series, which is a counterpart of the Cortlandt series, and borders the plateau on the west. Each marks the locus of a principal fault system which form, respectively, the eastern and western limit of the plateau. By contrast faulting is wanting or inconspicuous in all the central portion of the province.

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SCIENTIFIC BOOKS

Oxidations and Reductions in the Animal Body. By H. D. DAKIN, D.Sc., F.I.C., The Herter Laboratory, New York. Longmans, Green & Co., New York. 1912. Pp. viii + 135. Price $1.40 net.

For some time in the past, "energy" has been the keyword of the theories of nutrition. The problems presented in relation to the transformation of energy in the body were so conspicuous and the technique of investigation so effectively improved in application to the study of the metabolism of energy, that other aspects of the subject were neglected. This trend of the science is reflected in the popular literature of the present time when expressions like "calories" and "fuel value" are employed with the skill of the conjurer to impress the uninitiated. The mere comparison of the intake and the output of the organism and the broad statement that metabolism is essentially a process of oxidation change has, however, long since failed to satisfy the more critical inquirer; and accordingly the questions of what is now termed intermediary metabolism, concerned with the destiny of the individual nutrients or corresponding tissue components, are forging to the front. The newer knowledge of the chemistry of the digestive processes has made great strides in a decade or two. Yet how little we know of the various steps beyond the barrier of the intestinal wall.

It is of certain of these intricate processes considered primarily as chemical reactions that the present monograph aims to give an account. The animus of the attempt at what is essentially a novelty in the literature of physiology may be elicited from a few quotations. Dakin writes:

> The statements that fats and sugars are oxidized in the body to carbon dioxide and water, while proteins yield urea in addition, are no longer considered all-sufficient explanations of the chemical rôle of these substances in the animal economy. The study of chemical structure is rapidly changing the whole aspect of biological science, and we may confidently look forward to the time when the orderly succession of chemical reactions consti-

tuting the activities of the living cell will be resolved into their individual phases. . . . It is relatively easy to obtain a balance sheet representing the intake and output of substances in the animal body, but what is fundamentally necessary for the proper appreciation of this balance sheet is a knowledge of the various chemical transactions which (to continue the simile) should be comprised in a trading account. For it is by the proper adjustment and regulation of these transactions that the energy represented by food and tissue substance are economically utilized according to the varying needs of the body. The rapidly developing appreciation of the fact that different proteins, fats and sugars are not physiologically equivalent but that certain definite chemical groups subserve special functions in the animal organism emphasizes the necessity of the study of intermediary metabolism. . . . A true knowledge of metabolic processes can only be obtained by the tedious unravelling of the complex system of biochemical changes into individual chemical reactions. At the present time only a few of these simple reactions have been recognized and studied, but even now it requires little imagination to realize that in the future it will be possible to construct an accurately itemized account of the animal body's chemical transactions, both anabolic and catabolic. The value of such knowledge for the advancement of biology and medicine is sufficiently obvious.

Dakin's book emphasizes the fact that many of the striking biochemical reactions can already be imitated to-day more or less successfully by experiments in vitro. This is, of course, a helpful assurance, serving to divert attention from vague speculation regarding subtle vital forces. It has been a popular practise to appeal to hypothetical enzymes to explain some of the obscure chemical transformations in the organism. Thus we have been wandering through the mazes of the oxidases, oxygenases, peroxidases, reductases, catalases and other products of perplexing nomenclature in the hope of escaping the uncertainties of intermediary metabolism. Much of the obscurity is at length dispelled by a vigorous presentation in which questions of chemical structure are paramount and details of biological processes are exemplified in actual experiment or by clear analogy.

In connection with the oxidative capacity of the body Dakin points out the accumulating evidence in favor of the hypothesis of superoxide formation in living cells. With regard to the possibility of biochemical reductions reference is made to the interesting Cannizzaro reaction whereby the reduction of one molecule of substance takes place with the simultaneous oxidation of a second molecule, according to the scheme:

$$2\,R \cdot CHO + H_2O = R \cdot CH_2OH + R \cdot COOH.$$

A brief chapter on the methods of investigation formulates the attitude of mind with which the student of intermediary metabolism approaches his problems. It is a decidedly exceptional outline of the viewpoints which may guide the worker in this field in the direction of successful experimentation.

Pointing out that it is only since the publication of Knoop's important studies in 1904 that any material progress has been made in the experimental investigation of fatty acid katabolism, Dakin subjects Knoop's theory of β-oxidation to a critical analysis. He shows that chemical analogies for this are found in the behavior of fatty acids towards hydrogen peroxide, so that by the choice of a suitable oxidizing agent the occurrence of β-oxidation can readily be demonstrated *in vitro*. Physiological experiments continue to furnish striking confirmation of the theory. The relative importance of the β-hydroxy- and β-ketonic acids in the mechanism of the reaction are discussed with abundant reference to the growing illustrative literature to which the author of the monograph has furnished prominent experimental contributions. Other types of reaction than that of β-oxidation have not yet been observed, and it is not likely that α-oxidation of normal saturated fatty acids takes place in the animal body.

In turn the behavior of the unsaturated acids, the oxidation of acids with branched chains, the dibasic acids, aromatic compounds, amino-, hydroxy- and ketonic acids are reviewed. The intimate biochemical relation

of the latter groups, illustrated by the scheme,

$$CH_3 \cdot CHNH_2 \cdot COOH \rightleftarrows CH_3 \cdot CO \cdot COOH \rightleftarrows CH_3 \cdot CHOH \cdot COOH,$$

furnishes a text for the discussion of some of the manifold metabolic performances that have only lately found a place in physiological speculations. The oxidation and reduction of amino-acids by microorganisms, with reference to the splendid newer work of F. Ehrlich and of Neuberg in this field, is presented in novel, though brief form. In his treatment of the behavior of the carbohydrates Dakin champions the view that lactic acid must be regarded as one of the most important substances concerned with their intermediate metabolism. There are further chapters on the purines, hydrocarbons, phenols, etc.; and in conformity with the plan of the series of monographs on biochemistry to which this book belongs there is a well-arranged bibliography appended.

The frankness with which open questions are presented, as illustrated in the debated respective rôles of β-ketonic and β-hydroxy acids, is wholesome and marks the unbiased attitude of the book's author, even where his own researches are involved. The reader is impressed with the great advances which have lately been made in the new field covered by this monograph; and whether his interests are primarily those of the physiologist or the chemist, he will be stimulated by the wealth of suggestions—all presented there in a readable form.

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The North American Dragon Flies of the Genus Æshna. By E. M. WALKER. University of Toronto Studies. 1912.

It occasionally happens that some familiar group of animals is investigated by one who is sufficiently skilled and independent to detect characters which have escaped all previous observers. I recall the time, now a quarter of a century ago, when certain common land molluscs were added to the British list. One of these was almost literally in every one's garden, but until its distinctive characters were pointed out, nobody could see it. To-day the merest beginner can recognize it at once. We are forced to conclude that even excellent manuals are not without their disadvantages, when they are blindly followed by naturalists, who will not even look for things unmentioned by them. The same sort of thing has been very evident in botany, and we have in Mr. Walker's work a remarkable exposure of blindness in the field of entomology. Mr. Walker, during the summer of 1906, was at Lake Simcoe, Ontario, where he interested himself in the common large dragon flies of the genus *Æshna.* Most people would have viewed them with languid interest as being among the "familiar objects of the country side," completely exploited by entomologists long ago. Not so Mr. Walker, who with critical eye presently discerned that there were more species than the books called for. His curiosity thus stimulated, he pursued the subject further, and was eventually able to establish the existence of sixteen perfectly valid species in temperate North America, five of them described as new by himself. While doing this he has monographed the genus as represented in this country, and now publishes a most exhaustive treatment, discussing the biology, early stages, geographical distribution and other matters. The work is also fully illustrated, with 28 plates and some good text figures. Only one thing seems lacking: I find no mention of Scudder's *Æshna solida,* which is represented by such beautifully preserved wings in the Miocene shales at Florissant.

The interesting fact is brought out that in addition to "structural" characters, each species has its own color-pattern, which may at once be recognized when known. It is also found that the immature forms, the nymphs, have characters of their own, which are duly set forth in a key. It is thought probable or possible that the genus *Æshna* is of polyphyletic origin, the *californica* group especially having perhaps a different origin from the